Confidence, Collaboration, Trust – Developing An Interprofessional EMS Obstetric Skills Training Program

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A Master's Paper submitted to the faculty
of the University of North Carolina at Chapel Hill
in partial fulfillment of the requirements
for the degree of a Master of Public Health in
the Public Health Leadership Program.

Chapel Hill
2019

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October 27, 2019

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October 17, 2019

ABSTRACT

Background

Obstetric emergency calls (OB) in the City of Charlottesville are infrequent among Emergency Medical Services' (EMS) dispatch, giving EMS providers little exposure to out-of-hospital birth and few opportunities to improve their OB field skills. In contrast, midwives have regular exposure to home birth. The purpose of this participatory research paper is to examine trends in interprofessional training with simulation as a strategy for improving critical competencies; test the effects of a midwife-led, interprofessional training curriculum on EMS workers' self-efficacy; and foster partnerships to execute and scale the training.

Methods

Literature on interprofessional training with simulation was analyzed. Interviews, meetings, training manuals, and organization-wide surveys were assessed to measure EMS needs and certification standards. Follow-up surveys and interviews were evaluated after the training to measure outcomes.

Results

The literature revealed evidence that interprofessional training improves participants' confidence and skills. Initial interviews and meetings with EMS employees found low-confidence in the effectiveness of current trainings and a desire for simulations. Self-assessment surveys (n=66) showed 83.4% (n=49) of respondents lacked confidence in their OB skills. A follow-up survey was completed by 28 participants with responses matched to their pre-survey results. 50% (n=14) had at least one level of improvement in confidence.

Conclusion

Interprofessional training with simulation helps improve EMS crews' OB skills, capacity to collaborate with midwives in the field, and confidence levels. More research is needed, but initial results are promising for scaling interprofessional training to further municipalities and supporting partnerships between EMS and home birth midwives.

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INTRODUCTION

OVERVIEW

Of the 3,978,497 births in the U.S. in 2015, 1.5% of them occurred at home with a midwife, and approximately 3% took place in a hospital to uninsured mothers (Center for Disease Control and Prevention, 2017). The women who birth at home and those uninsured women birthing at a hospital have little in common – 47.8% of the uninsured mothers are below the federal poverty line and receive little to no prenatal care (Medicaid and Chip Payment Access Commission, 2018), whereas 70% of home birth mothers self-pay for services and receive full-spectrum maternity care (MacDorman & Declercq, 2019). What these women share is a dependency on Emergency Medical Services (EMS) for emergency perinatal care. In an effort to increase EMS crews' confidence, knowledge, and skills in obstetric (OB) emergency calls, as well as their rapport with local midwives, a new simulation-based, OB training curriculum was designed with the ultimate goal of improving outcomes for all women having an out-of-hospital OB emergency. The target of this initial training program was EMS workers in the Charlottesville Fire Department (CFD).

BACKGROUND

Emergency Medical Services (EMS) and Obstetric Emergency Calls (OB)

EMS in the city of Charlottesville are predominantly provided by CFD firefighters and the volunteer Charlottesville Albemarle Rescue Squad (C.A.R.S.). Calls for OB incidents in Charlottesville make up just .4% of all dispatches. From January 2017-2019, CFD had an average of 60 OB calls per year (CFD, 2019). In comparison, CFD crews were dispatched 1,400-1,500 times per year for breathing problems.

Non-emergent prenatal complications account for the majority of all CFD OB calls (CFD, 2019). Most of these calls are initiated by women with low resources, who lack prenatal care or continuity of prenatal care. Because OB calls are rare, and often dispatched for non-emergencies, CFD crews generally have low confidence and high anxiety when called for OB care. They also have few opportunities to sustain or improve their OB emergency and field-birth skills.

Emergency Medical Services (EMS) and Midwives

According to the Centers for Disease Control and Prevention's (CDC), out-of-hospital deliveries (those considered "in the field:" pre-hospital, at home, or a birthing center) represented about 61,000 births in 2015. This is the highest documented number of out-of-hospital births since reporting began in 1989. Of the planned out-of-hospital births reported in 2015, 63.1% were at home and 30.9% in a freestanding birthing center (CDC, 2017).

In Virginia, both Certified Professional Midwives (CPM) and Certified Nurse Midwives (CNM) may practice out-of-hospital births. In Charlottesville, there are five licensed midwives providing full-spectrum maternity care: three for home births and two at birth centers, all serving the city and surrounding counties. This is the highest number of out-of-hospital licensed birth providers practicing in the city since Virginia CPM licensure took effect in 2006.

In September 2017, EMS was dispatched to a birth center in Charlottesville for a newborn in distress call. A crew from CFD was the second to arrive at the scene. They reported a delay in initiating 9-1-1, improper neonatal resuscitation, and chaos between the lead midwife and the team. The crew took over resuscitation and transported the baby to the NICU. The baby died two days following the call.

Needs and Opportunities

Nine months later, the Charlottesville midwives not part of the birth center accident called a meeting with the Deputy Fire Chief (DC) in an effort to establish rapport with CFD, distance themselves from the birth center's midwifery team, and avoid conflicts with EMS crews. Conflicts between midwives and EMS result from miscommunication, lack of understanding about scopes of practice and responsibilities, and mistrust in capacity and competencies – all of which intensify the degree of the emergency (Vedam et al., 2014). The DC had tried to improve her crews' OB skills following the incident to increase their readiness for birth emergencies. During the meeting the DC learned the midwives were comfortable and proficient in dealing with obstetric emergencies in the field. Following the meeting she invited them to collaborate in developing an innovative, interdisciplinary OB training program for her crews that included skill simulations, trust-building exercises, and supported the midwives as

lead trainers. Research into curriculum development began immediately, and the training was proposed for May of 2019.

LITERATURE REVIEW

As a practicing doula and midwife's assistant in Charlottesville, and a Masters in Public Health candidate at the University of North Carolina's Gillings School of Global Public Health, I was interested in learning how to effectively engage in evidence-based practice (EBP) – where care decisions are based on critical, reliable systematic research, clinical expertise, and patient values (Melnyk, Gallagher-Ford, & Fineout-Overholt, 2014). Evidence-based practice in public health is also embedded into the midwifery model of care, which "is informed and guided by formal and continuous education, scientific research, and application of evidence" (International Confederation of Midwives, 2014). Thus, as the facilitator of the EMS curriculum development and training, I made decisions on content and training protocols based on EBP. My evidence gathering relied on the partnerships between CFD and the midwives, resembling community-based participatory research (CBPR) which honors the "existing relationships, needs, and assets" within the organization (Ammerman, Smith, & Calancie, 2014, p.52). Essentially, I sought to develop practice-based evidence by collaborating with as many stakeholders as possible to identify training policies most likely to meet CFD leaderships' goals. The following literature review reflects that intention, exploring the intersections of EMS and obstetrics, the practice of partnership development and CBPR, and the recommendations for interprofessional curriculum that includes skill simulation.

EMERGENCY MEDICAL SERVICES AND OBSTETRICS

Data on pregnancy-related EMS utilization nationwide is limited, but an initial review found the majority of dispatches are non-emergent. According to the National Emergency Medical Services Information System (NEMSIS) Data Cube, there were 7,619 pregnancy-related events recorded nationwide from 2014-2017, and 85.7% were non-emergent. A recent retrospective cohort study of pregnant Medicaid recipients in North Carolina who used emergency care found that most ER visits were related to non-emergency prenatal events, such as abdominal pain, nausea, and bleeding (Vladutiu, Stringer, Kandasmy, Ruppenkamp & Menard, 2019). Generally, EMS calls from home birth patients under midwifery care also tend to be non-emergent. The leading cause of transfer to hospital care among all out-of-hospital planned births is maternal exhaustion or failure to progress, both of which are non-emergent (Blix, Kumle, Kjærgaard, Øian, & Lindgren, 2014). Only approximately 2.5% of mothers using birth centers and 5.5% of those having home births require emergency transfers to the hospital (Stapleton, Osborne, & Illuzzi, 2013; Blix, Kumle, Kjærgaard, Øian, & Lindgren, 2014).

PARTNERSHIPS AND ENGAGEMENT

As lead facilitator and researcher of the training, design and development of the curriculum and training inherently became aligned with principles of community-based participatory research (CBPR). The literature review for CBPR in general revealed 3,417 results which were reduced to 951 when filtered for peer-reviewed articles which were published in the last five years and related to public health. When screened by title and abstract for general effectiveness of CBPR, best practices, partnership development, researcher participation, and stakeholder engagement, results were limited to 171 articles. Clinical trials, geographically

specific studies, or narrow topics of focus were excluded. Full texts were screened for relevance and eligibility leaving six articles for review.

CBPR is a method in which the community or recipients of an intervention engage and collaborate with researchers to develop and implement that intervention together (Faridi, Grunbaum, Gray, Franks, & Simoes, 2007). CBPR relies on equitable partnerships between researchers and stakeholders to share in the research process, learn together, and cooperate to build capacity for the intervention's implementation (Samuel et al., 2018). The majority of CBPR literature in general attributed success of most programs to equity in power-sharing and shared decision making. This co-governance requires a foundation of trust between partners. Once trust is established, it must be sustained throughout the program development process, and thus requires ongoing maintenance (Jagosh et al., 2015). This can be achieved through cooperative creation of a framework for resolving conflicts, and regular check-ins to evaluate partnership commitments to common goals (p.4). Christopher, Watts, McCormick and Young's (2008) review of best practices for trust building recommended: including recognizing personal and organizational histories, active listening, identifying areas of expertise, setting expectations, and committing to follow-through (p.1400). Tuefel-Shone et al. (2018) warned that building trusted partnerships takes time, and researchers must allow for negotiations, vision and mission development, and conflict resolution (p.9).

Barriers to CBPR partnership development include uncertainty about accountability, funding, and partnership structure (Samuel et al., 2018), lack of cultural competence and sensitivity (Christopher, Watts, McCormick & Young, 2008), logistical challenges - such as organizing schedules of multiple stakeholders (Jagosh et al., 2015), and unequal distribution of workload in research reporting and evaluation (Tuefel-Shone et al., 2018).

Overall, CBPR can provide significant gains for both the researchers and the community of focus with CBPR: knowledge-sharing, improved relationships between stakeholders and partners, access to essential qualitative data, and a sense of empowerment for all participants – during both the collaborative research process and the implementation of that research (Paradiso de Sayu & Chanmugam, 2016).

CURRICULUM DEVELOPMENT

There is an abundant literature on strategies and recommendations for curriculum development, i.e: interprofessional learning and education with simulation. The literature review revealed 1,825 results which were reduced to 504 when filtered for peer-reviewed articles which were published in the last five years. When screened by title and abstract for scope of simulation training, obstetrics, midwifery, nursing, or emergency services, results were limited to 29 articles. Topics such as staffing, online education, computer simulation, and surgery education were excluded. Finally, full texts were screened for relevance and eligibility leaving six articles for review. Three articles explored the effectiveness of interprofessional learning with simulation as tools for improving participants' skills, collaboration, and communication. The remaining three specifically evaluated programs where midwives and paramedics trained together with simulations.

Benefits to Interprofessional Learning and Simulation

Three of the articles analyzed interprofessional learning paired with simulation. Results of the reviews and studies were similar: interprofessional learning which incorporates simulation can improve core skills, critical thinking, teamwork, identification and respect for roles,

confidence levels, and skill retention (Costello et al., 2017; Granheim, Shaw & Mansah, 2017; Lee, Pais, Kelley & Andersen, 2018).

Granheim, Shaw and Mansah (2017) evaluated 35 studies of nursing training programs which concurrently integrated interprofessional learning and simulation. The studies shared four areas of skills improvement: collaboration, experiential learning, role identification, and communication (p. 121). Because students of varying disciplines were able to work together in a simulated clinical environment, they could explore alternatives to issues and innovate solutions without the threat of causing patient harm. This fostered a deeper level of engagement and understanding as they tackled problems by clarifying roles, resolving conflicts, and communicating openly. Not surprisingly, the two skill areas of most impact were collaboration and communication, being the catalysts for successful simulations by interprofessional teams. Hence, collaboration and communication skills showed the greatest improvement across all participants (Granheim, Shaw & Mansah, 2017).

In a more concentrated study, Costello et al. (2017) examined 122 students from four disciplines (from one university) and their impressions of an interprofessional community health training with simulation (p.625). Surveys were distributed to participants before and after the training to determine their levels of experience in interprofessional learning, attitudes about the training, and competencies achieved. Students each attended one, 2.5-hour training session and were surveyed again following their sessions within three weeks of completion. The results were similar to Granheim et al.'s findings: communication above all other skills improved in health trainings with simulation, followed by collaboration, and a respect for roles and responsibilities (p.627).

Finally, Lee, Pais, Kelley & Andersen (2018) performed a scoping review of 93 articles

(eight of which were specifically related to the paramedic profession) to map how extensively interprofessional learning and simulation were utilized in health professions. Emergency responsiveness and "role play" simulations were the most commonly integrated into the trainings, often utilizing mannequins and participants as actors (p. 16). Trainings proved most successful when at least two different disciplines were represented among both participants and teachers; curriculum was reflective of the expertise of the group as a whole; multiple students attempted the same skills, so skills were repeated in close succession; simulations were realistic; and teams debriefed after their trainings. The repetition of missed skills combined with the debriefing process had the most impact on participants' confidence levels, relieving anxiety about their capacities in real-world scenarios, improving collaboration, and promoting open communication in a safe and supported framework (Lee, Pais, Kelley & Andersen, 2018).

Benefits of EMS and Midwives Learning Together

The remaining three studies specifically focused on EMS providers (paramedics, EMTs) learning OB skills from, or with, midwifery students. As with the previous articles, the overall outcomes were positive. The main difference was that confidence levels in core competencies were most improved compared to collaboration and communication skills. This may be attributed to the more narrow focus of simulations and the limited number of participating disciplines.

Pauley and Dale (2016), British midwives and researchers, examined the effectiveness of home birth obstetric emergency skills training with 36 participants from Hinchingbrooke Health Care Trust – including student midwives, practicing midwives, maternity care providers, and paramedics (p. 428). During the half-day training, midwives acted as facilitators prompting

discussions on emergency situations, leading role-play simulations, and using mannequins for more equipment-based technical drills. The training was evaluated with an anonymous follow-up survey. Results were positive with 100% of participants reporting increased skills acquisition and perceived benefit of the training. Additionally, the majority of written comments by participants affirmed an increased level of confidence and knowledge in OB emergency skills and an elimination of misconceptions about capacity and expertise. This increased levels of cooperation and optimism between the midwives and paramedics.

Feltham, Foster, Davidson, and Ralph (2016) facilitated a 6-hour (one-day) workshop for 25 student midwives and 31 paramedic students to determine the results of interprofessional learning with simulation. The workshop opened with a discussion on the scope of the participants' disciplines, including respective governing bodies and prescriptive authority (p. 74). The afternoon was spent performing role play simulations of pre-hospital, OB emergency drills. Following the workshop, all participants were invited to focus groups, segregated by discipline, to discuss the training. Results of the focus groups were divided into four categories: roles and responsibilities, interprofessional learning as a technique, opinions on the structure of the workshop, and opportunities for improvement. In the area of skills gained, the highest ranking were identification of roles, improved cooperation and collaboration, and increased confidence in skills through simulation. Students from both professions fundamentally improved their reliance on each other in team-based scenarios, and valued the other's perspective and contributions to clinical problem-solving (Feltham, Foster, Davidson & Ralph, 2016).

Last, McLelland et al. (2017), performed a quasi-experimental descriptive study to assess the impact of interprofessional learning on clinical skills for a simulated, pre-hospital, unplanned birth. Twenty-four midwifery, nursing and paramedic students from one Australian university

cooperated to manage the simulation and debrief afterwards. All participants were then surveyed to assess improvements in self-efficacy. The results were positive and when students were re-surveyed three months following the simulation, skills were retained. For the nursing students, skills improved. Additionally, students' post-simulation (ie: real-world) attitudes towards interprofessional collaboration and communication greatly improved (p. 29). As with the other studies, the students not only displayed increased confidence in their disciplines' core competencies, but also in their ability to work together to promote innovative, effective solutions to OB emergencies.

Barriers and Limitations to Interprofessional Simulation

All of the articles reviewed reported challenges to interprofessional simulation, mainly the ability to schedule participants and teachers from multiple disciplines at the same time to create meaningful, interprofessional outcomes (Granheim, Shaw & Mansah, 2017; McClelland et al., 2017). Additionally, limited logistical resources – simulation tools and equipment, appropriate locations, and funding – were mentioned as barriers (Lee, Pais, Kelley & Andersen, 2018; Feltham, Foster, Davidson & Ralph, 2016).

From a participant perspective, novice students noted a perceived disadvantage during simulations, reporting that their lack of previous experience was obvious (Feltham, Foster, Davidson & Ralph, 2016; Granheim, Shaw & Mansah, 2017; Lee, Pais, Kelley & Andersen, 2018). This hindered their confidence and engagement levels, as well as their skills acquisition. Also, a professionally facilitated debriefing was documented as the most effective method for participants to contribute meaningful feedback, yet it was missing from most of the training

programs. Feltham et al.'s (2016) focus groups functioned as a debriefing, with the disclaimer that they were only as effective as their facilitators.

From a study method perspective, the Lee et al., article (2018, p. 20) echoed the challenges mirrored by Granheim's literature review: the research on the effectiveness of interprofessional training with simulation is emerging and thus limited; studies often failed to have control data or comparison data, inhibiting clear conclusions, sample sizes were small and prone to bias, and surveys had insufficient data collection. Ultimately, more standardized research and protocols are needed to improve reliability and measure the effectiveness of interprofessional learning with simulation.

Summary

Ultimately the literature review justified a community-based participatory approach to partnership development and process, as well as interprofessional education with simulation for the curriculum – with the caveat that challenges and barriers exist and need heeding. If the training was to be successful its stakeholders and trainers would need to equally share in decision making and project ownership; establish trusting relationships; determine knowledge gaps (prior to training) and evaluate knowledge gains (post-training); appeal to common skill sets; allow the curriculum to incorporate role play, relevant simulation scenarios, and discussion; and facilitate a post-training discussion.

METHODS

EMERGENCY MEDICAL SERVICES AND OBSTETRICS

The training team held open-ended interviews with CFD leadership. midwives and support personnel to assess needs and evaluate attitudes towards the OB training (See Table 1, below). Two were held with the Deputy Fire Chief (DC) to establish her priorities, objectives and goals for the training; one with the Operational Medical Director (OMD) to ascertain his level of interest in the project, willingness to participate, and availability; one with a former CFD pediatric and OB training consultant and the DC to discuss previous successes in training the crews; two total with the midwives to determine their readiness and capacity for the project; one with the lead Training Officer to determine logistics and simulation training capacities; and last with the Deputy Chief of the Charlottesville-Albemarle Rescue Squad, who was the lead paramedic on the birth center call, to discuss the accident and get recommendations for effectively designing the training program from a participants' perspective. Interviews were scheduled through email. Interviewees were asked similarly worded, open-ended questions based on a user-centered (design thinking) approach to inform a needs assessment. Interviews were transcribed and assessed for common themes across stakeholders. All interviewees were sent follow-up thank you emails which included invitations to continue the dialogue with upcoming opportunities.

Table 1. EMS and OB Interview Method

Resources	Activities	Frequency	Method
Deputy Fire Chief	Interviews	Three (3)	In-person interview with notes
Operational Medical Director	Interview	One (1)	Email and in-person
OB Training Consultant	Interview	One (1)	In-person interview with notes
Midwives	Interview	Two (2)	In-person and phone calls with notes
Lead Training Officer	Interview	One (1)	In-person interview with notes
Deputy Chief, Rescue Sqaud	Interview	One (1)	In-person interview with notes

PARTNERSHIP DEVELOPMENT

In order to ensure cooperation between CFD leadership and the midwives, partnerships had to be developed between the community midwives and the fire department training staff. A summary of partnership activities appears below, in Table 2. An initial meeting was called by the DC to introduce the lead midwives to CFD's EMS Administrator. The EMS Administrator was responsible for all continuing EMS education and recertification of all crews. The meeting was preceded by an emailed agenda and included introductions, roles, and educational background.

During the meeting, the midwives discussed their experiences and expertise in the field as well as their desire to collaborate with CFD. The EMS Administrator explained CFD's position on the birth center accident, and the logistics, requirements, and expectations of any OB training.

A second meeting occurred in the following month with the same participants with the addition of the OMD and a practicing homebirth midwife from the community who had not attended the original meeting. Again, an agenda was emailed ahead of the meeting. Training objectives and goals, pre-and post- training survey requirements, and roles and responsibilities, were discussed. The meeting was followed up with an email to all participants with minutes and recommendations for next steps.

Table 2. Partnership Building Methods

Resources	**Activities**	**Frequency**	**Method**
Deputy Fire Chief	Meetings	Two (2)	In-person, with agenda emailed ahead and minutes
Operational Medical Director	Meeting	One (1)	In-person, with agenda emailed ahead and minutes
EMS Administrator	Meetings Follow-up	Two (2) Five (5)	In-person, with agenda emailed ahead and minutes Emails

Local Midwives	Meetings Follow-up	Two (2) Five (5)	In-person, with agenda emailed ahead and minutes Emails
Lead Training Officer	Meeting	One (1)	In-person

CURRICULUM DEVELOPMENT

Assessment: Document Review

The Virginia Emergency Medical Services Educational Standards (VEMSES) details required obstetrics and neonatal skills for entry-level EMS providers' certification (Virginia Department of Health, 2012). The majority of content in the VEMSES document addresses prenatal, labor and delivery complications and emergencies. Topics covered which were non-emergent include assessment of the pregnant patient, anatomy and physiology of pregnancy, and bleeding (VDH, 2012). Documents previously chosen by CFD for OB training materials which met VEMSES certification requirements were assessed for training curriculum content. These included the Obstetric Advanced Life Support training materials, The Thomas Jefferson Emergency Medical Services Council Adult and Obstetrics Care Guidelines, the National EMS Standard Competency Guidelines for Obstetric Care, and the University of Virginia Prehospital Care, Care of the Newborn: Using NRP in the Field continuing education materials. Additionally, Board of Medicine guidelines were reviewed for Certified Nurse Midwifery licensure and practice standards within the commonwealth. Finally, Stapleton, Osborne & Illuzi's 2013 study on birth center outcomes, and the Institute for Clinical Effectiveness and

Health Policy's (2016) OB Emergency Drills Trainer's Manual were evaluated for frequency of field emergencies, recommendations for skills inclusion, and best practices.

Assessment: Survey

An online OB skills self-evaluation survey was constructed in the Typeform online survey platform. The survey consisted of 22 questions: 10 multiple choice, five true/false, five Likert Scale, two open-answer fields. Survey questions were created in collaboration with all of the participants of the partnership meetings, and reviewed by three local home birth midwives for accuracy. Additionally, a statistician and survey designer were consulted to ensure the questions – particularly those using the Likert scale – would capture data relevant to the training objectives. Questions were divided into three categories: OB Training and Call Attendance (how many OB calls attended in a six-month period), Self-Appraisal (OB skills, attitudes towards OB calls and midwives), OB skills (specific scenario questions), and Midwifery (general knowledge) (See Appendix A). To accommodate shift rotations, the Typeform link was distributed via email by the EMS Administrator to all crew members (n=90), one month prior to the first scheduled training. The EMS administrator, mindful of CFD culture, reminded crews that the survey was confidential, and their answers would not be used in any way to measure their performance or skill set. Of those emailed, 73.3% responded (n=66) with complete surveys. Answers were collected, sorted and analyzed by Typeform, with multiple choice questions compared against correct answers from training documents.

Development: Design and Implementation

During the second CFD meeting, the EMS Administrator voiced concerns that the current CFD OB training curriculum was too generalized to appeal to the crews, and it lacked simulations — which had been proven productive for medical training curricula (Cooper et al., 2011). Thus, it was determined the midwives leading the training would simulate OB emergency scenarios with the help of participants. The OMD sought to have the collaboration and cooperation pieces of the training prioritized, so slides would include a video of a home birth and content would cover midwifery certification procedures, licensure, roles, skills, and scope of practice. Finally, recommendations and protocols for co-managing a home birth transfer to the hospital would be reviewed.

Training content and simulations that met education requirements established by the VEMSES were meant to demonstrate:

- Field-skills which had scored lowest in the survey;
- Birth emergencies which were considered the most common as determined by both the Stapleton, Osborne & Illuzi's study (2013) and the Institute for Clinical Effectiveness and Health Policy (2016);
- Skills recommended by Advanced Life Support training materials, The Thomas Jefferson Emergency Medical Services Council, the National EMS Standard Competency Guidelines; and University of Virginia Prehospital Care, Care of the Newborn: Using NRP in the Field continuing education materials
- Emergencies which midwives encounter most in the field and could provide insights using evidence-based practices;
- Scenarios which could be executed with limited materials and budget;
- Scenarios which could be completed within a 2-hour training period.

The 2-hour training was offered twice daily, once a week, for three consecutive weeks. Trainings occurred in the CFD main fire station training room. Crews whose 3x-24-hour shifts were scheduled during any training day were required to attend. Of the 66 survey respondents, 60% (n=40) attended the training.

Evaluation: Follow-up Survey

In order to measure the effectiveness of the training, the Typeform follow-up survey was emailed by the EMS administrator to all training participants within 24 hours of their respective training. This follow-up survey was identical to the pre-training survey with the exception of one additional open-form question requesting feedback (not required). The email accompanying the survey requested all participants complete their surveys within three weeks of receipt. Followup email reminders were sent weekly to all those who had not completed the survey. Also, the DC circulated an email personally requesting all crews complete the survey by their respective deadlines. 70% of all training participants (n=28) completed the follow-up survey. Responses for each participant were matched to their pre-training survey responses and changes recorded.

RESULTS

Initial interviews and meetings with CFD leadership found low-confidence in the effectiveness of current trainings and a desire for a new curriculum which incorporated introductions to the field of midwifery, OB and neonatal emergency simulations, and guidelines for co-managing patients with the help of midwives. Meetings with midwives and CFD revealed a desire to closely collaborate in training curriculum development and execution. Finally, a self-

assessment survey was sent to crews before the training and assessed for gaps in knowledge and levels of confidence in OB skills. The same survey was distributed following the training, matched to pre-training responses, and evaluated for levels of improvement in confidence.

EMERGENCY MEDICAL SERVICES AND OBSTETRICS

Interviews with CFD leadership and the midwives produced three common themes: confidence, collaboration, and trust. Transcripts from the interviews revealed that the DC and OMD presumed their crews were uncomfortable when being dispatched on OB calls, and this was not only for the nature of the call, but the lack of confidence in their skills due to the low exposure and frequency. The interview with the OB Training Consultant reinforced the need for instilling confidence in the crews' neonatal skills, where they traditionally have the most anxiety. The interview with the Deputy Chief of the Rescue Squad revealed that the secondary EMS crews on the scene of the birth center accident were unconfident and unhelpful during the emergency, and all of the crews were devastated by the accident. They blamed the death on the delay in care that they believed was due to the incompetence of the birth center's lead midwife.

All of those interviewed expressed an interest in collaborating with the training team and their fellow stakeholders to produce a training that was engaging, compelling, and different from previous trainings. The Deputy Chief of the Rescue Squad was open to collaboration with the midwives and especially sought to establish common ground for co-managing patients and continuity of care.

Last, all of those interviewed discussed the need to establish rapport with their fellow stakeholders. CFD Leadership knew very little of midwives' protocols in the field, nor of their levels of expertise, but recognized these credentials could reassure their crews of the midwives'

trustworthiness and capacity. The midwives, accustomed to being the outliers in the medical field, wanted to be respected for their skillfulness and to be trusted to collaborate and share power with CFD leadership. And the Deputy Chief knew it would take a lot of evidence and reassurance to trust the midwives after the birth center accident, but was optimistic it was in his crews', the midwives' and their patients' best interest to trust each other to work together as a team.

PARTNERSHIP DEVELOPMENT

Interprofessional collaboration was the OMD's priority. He set the expectations for the training content and defined additional EMS protocols associated with VEMSES standards which encouraged interdisciplinary collaboration in the field. CFD leadership also promoted the collaborative aspect of the training, and were impressed with the high skill levels and years of experience among the midwives. The midwives expressed excitement for the opportunity to collaborate with CFD and to have access to the crews who they rarely meet in the field, but rely on to transport their patients.

Though the birth center accident led to a distrust of midwives in general, the open dialogue during the meeting persuaded CFD leadership to recognize the value in the midwives' field experience. Discussions on standards of care vs. evidence-based practices helped to establish common ground, and spurred ideas for the training curriculum. The connections made between participants helped ease the difficulties of coordinating logistics, and they readily volunteered for responsibility and coordinated research to advance curriculum development.

CURRICULUM DEVELOPMENT

Document Review

The document review provided guidelines on OB skills, EMS obstetrics and neonatal certification procedures from the VEMSES, and CFD selected OB skills for all levels of providers. Topics and skills common to all documents were maternal anatomy, physiologic birth ("normal birth"), treatment of breech delivery, nuchal cord, cord prolapse, post-partum hemorrhage, pre-eclampsia, and neonatal resuscitation. Recommendations for procedures and protocols were integrated into the training simulations.

Pre-Training Survey

Of the 66 respondents, 66.7% (n=44) had not been on an OB call in over six months, 83.4% (n=49) acknowledged they were "not confident" to "moderately confident" in their OB skills and protocols, and 19.7% (n=13) reported negative feelings when being dispatched on an OB call. That said, 70.6% of all respondents (n=46) accurately answered OB skills questions, implying they had retained most of the information from their last (non-interprofessional) training. As shown in Figure 3, below, the biggest knowledge-gap was in the midwifery category. Half of all respondents answered "I don't know" to any question related to midwives and their scope of practice, and less than 20% answered any midwifery questions correctly. The results from the self-appraisal and midwifery categories identified two areas to address during the training: midwives' roles, scope of care and responsibilities (50%, n=33 answered "Don't know"), and midwives' licensing and prescriptive privileges (57.6% - n=38 answered "Don't know."). The OB skills category results indicated weaknesses in postpartum hemorrhage (50%

incorrect, n=33), cord prolapse (34.9% incorrect n= 23) emergencies, and 48.4% (n=32) uncertainty about allowing a midwife to provide continuity of care on the ambulance during transport.

Figure 3. Sample, Pre-Training Survey Results

Training Curriculum

Up to four crews (17) attended per 2-hour training, with 40 participants total. The training was led by two birth professionals: a local midwife who runs a full-spectrum maternity center in a low-resource community in Northern Uganda, and trains first year nurse-midwifery students at Yale University; and this researcher, an MPH candidate and local Charlottesville-based birth doula and birth advocate.

The first part of the training was in lecture format, supported by slides, video, and demonstration. The following is the outline of slides (See Appendix B):

- Introductions + Objectives
- Discussion on the "three delays" framework of maternal mortality (Thaddeus & Maine, 1994)
- Physiological birth and the midwifery model of care (demonstrations included props with a pelvis, infant doll and plush placenta/umbilical cord simulator)
- Background on out-of-hospital birth and midwives' roles in such (videos of home births)
- Virginia midwifery licensure and prescriptive authority
- Midwifery protocols, evidence-based practice, and skillset (demonstration of equipment a midwife commonly brings to a home birth)
- Reasons for Transfer to EMS
- Co-Management of a home birth transfer

The second part of the training covered three field simulations of birth emergencies: cord prolapse, neonatal resuscitation and postpartum hemorrhage. Each simulation was presented with background information on each possible emergency for that simulation, guidance on how to best participate, the goal of the simulation and expectations, and a description of the scenario. Simulations involved volunteer participants as the "lead" and support team on each call, with the

trainers acting as lead midwife and patient. Ambulance equipment, such as a spinal board and jump bag were provided by CFD. The trainers used equipment common to a home birth supplied by the lead midwife: a stethoscope and pediatric stethoscope, delee suction trap, and obstetric doppler. Props included an infant doll with plush detachable umbilical cord and placenta, simulation blood, and birthing simulation pants – scrubs with an opening mirroring a vagina. The hemorrhage simulation involved a change in role play with a volunteer crew member wearing the birthing pants and acting as the patient. This brought a sense of humor to the scenario and energized remaining participants who had not yet volunteered for earlier simulations.

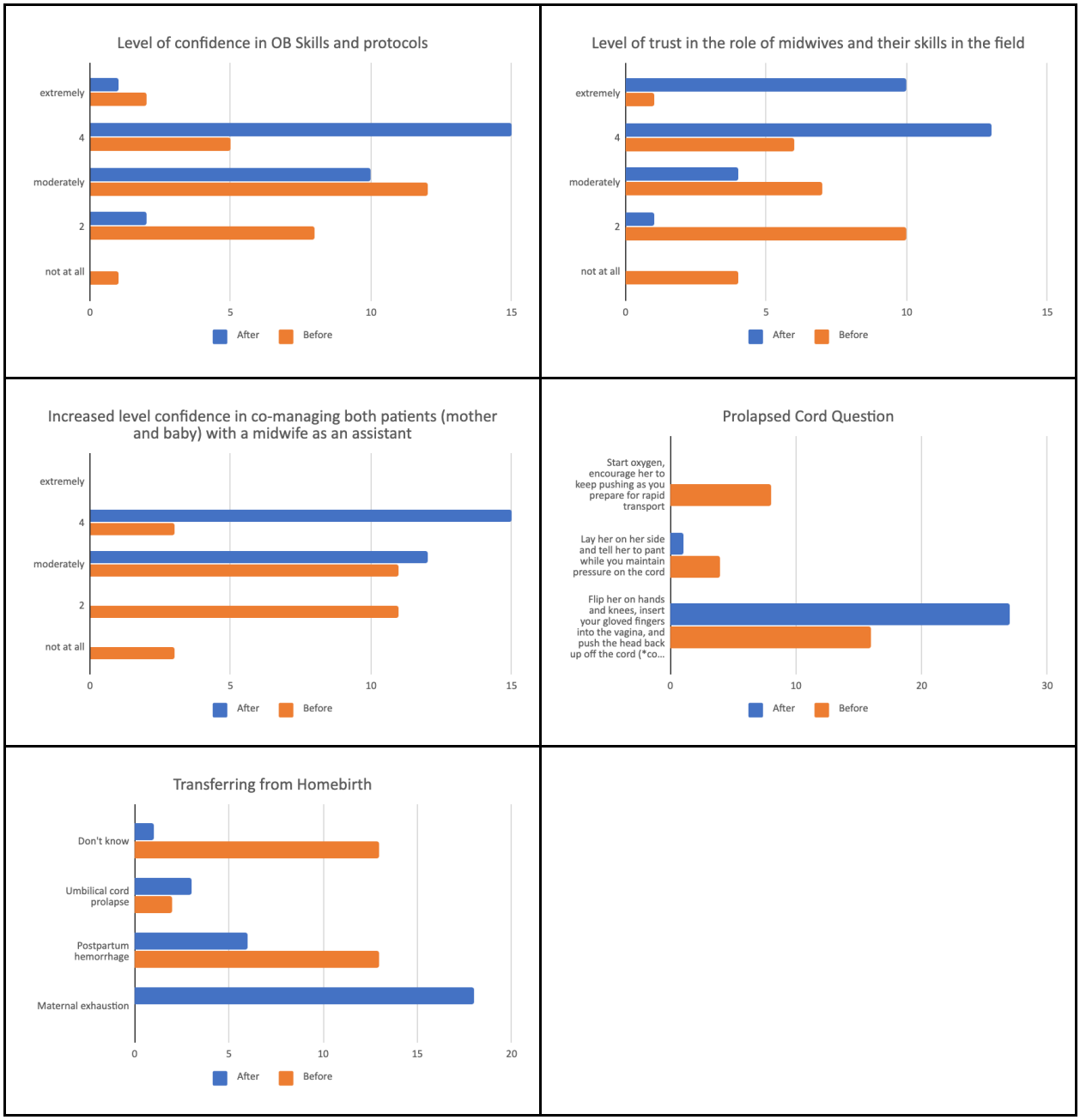
Crews attending trainings at the start of their shifts engaged in the first portion of the training, the majority of them asking questions and responding to videos and demonstration. Crews at the end of their third x 24-hour shift tended to be less responsive to questions and discussion, possibly due to fatigue. Upon completion of the simulations, one of three local midwives joined the group to introduce herself, describe her practice, and answer questions. When finished, there was a brief question and answer period to gain immediate feedback on the training, what worked and what didn't, and then a reminder to complete the upcoming follow-up survey.

Follow-up Survey

Results of the follow up survey reported that 50% of all respondents had at least one level of improvement in confidence for OB skills and excitement when being dispatched on an OB call. 39% of respondents who had incorrectly answered questions in the initial OB Skills section answered them correctly in the post survey (see Figure 4). The most profound shift was in the midwifery section where of the 17 respondents who had previously answered "I don't know" to

questions in relation to midwives' roles, scope and responsibilities, 16 had now accurately answered at least one question.

Figure 4. Before and After Training Sample Results



All respondents had at least one positive degree of change in outlook or accuracy. It appeared that the training was successful in fostering respect for home birth midwives and their expertise in the field, as well as encouraging rapport between the visiting midwives and the crews. Perceived confidence levels had also improved. When asked for voluntary feedback on the follow-up survey, responses were predominantly positive:

> "*I really enjoyed this dynamic training and would like to see more training like this at work*."
>
> "*...I feel much more confident about the skills and scope of practice of registered nurse midwives*."
>
> "*The class that was presented was interactive and interesting…*"
>
> "*Nice introduction into the world of midwifery. Learned that they were much more prepared and involved in the mother as well as baby's care.*"
>
> *"It was great having a visual presentation of the prolapsed cord. More training should be like this in the future!*"

The follow-up survey confirmed the interprofessional training with simulation was well received, helpful, and immersive.

TOOLS FOR PRACTICE

The CFD training program evaluation plan includes analysis of partnership development and short and long-term outcomes of the training curriculum. The results of that analysis are reported to CFD leadership, stakeholders, and partners in order to improve the curriculum for future trainings and identify opportunities for additional areas of interprofessional collaboration. A logic model and implementation plan outline the partnerships and steps necessary to achieve a successful and cooperative new OB skills training.

EVALUATION PLAN

The evaluation of the CFD training program was limited to analyzing the results of the follow-up survey and participants' feedback. In order to scale this program to further organizations or municipalities and measure its short and long-term effectiveness, an evaluation plan is recommended. Two aspects of the training can be measured and evaluated: partnership development and short and long-term outcomes of the training curriculum. Partnership development can be monitored by tracking the depth of commitment of EMS leadership and participation from local midwives. The training program leader can record attendance and accomplishments of stakeholder meetings as they relate to curriculum development, and log which decisions which are arrived at collaboratively, or by interprofessional methods (CTB, n.d.). During the training, the leader can measure partner engagement and contributions. Following the training, an experienced facilitator can debrief partners to determine their sense of success, the quality of their shared decision making, their sense of empowerment and partner dynamics, and their overall levels of trust.

Tracking outcomes of the training can be achieved in the short term with the follow-up survey. In the long term, an ongoing observational system would need to be established to evaluate how confidently crews respond to OB calls, if they interact with midwives in the field, and if they integrate the skills taught. Current EMS codes from 9-1-1 identify the type of complaints or incidents for which OB calls are dispatched. Though CFD reported that adding new codes to this system is complex, there is a possibility that a code which identifies an OB dispatch attended by a midwife could be created prior to the training. This would allow tracking of the rate of EMS and midwifery intersections in the field, and crews and midwives could be interviewed following those calls to determine the quality of protocol adherence, skills, cooperation and collaboration.

Table 5 illustrates how Kirkpatrick Four Levels training evaluation tool can be applied to assess the training participants' "Reaction" (their level of engagement and relevance to their work); "Learning" (the amount of skills, knowledge, attitudes, confidence and commitment acquired), "Behavior" (how much of the training is being applied to their jobs and how much is it reinforced) and "Results" (the amount of positive impact and consistency of new skills in use) (Office of Personnel Management, 2011).

Table 5. Kirkpatrick Four Levels Training Evaluation

1. Reaction	**2. Learning**	**3. Behavior**	**4. Results**
What did participants learn? Did they like the training?	How much did the participants learn? Did what they learn align with the training objectives?	Has the training influenced participants' confidence in the field?	Has the training had any impact on the EMS providing organization as a whole?

Did they like the trainers? Was the material compelling?	Did their knowledge skills improve?	Do they feel less anxious when dispatched on OB calls? Are they using any skills learned in the training in the field?	
Tool: Post training survey and facilitated group feedback	**Tool:** Post training surveys compared to pre training survey	**Tool:** Surveillance by leadership and administrators, coding of OB calls	

EVALUATION REPORT

The results of an evaluation plan should be included in a report that is distributed to EMS leadership, the lead trainer, stakeholders and partners, and ultimately, the state Operational Medical Director. It should detail the lessons learned from the training program – from both partners and participants – as well as recommendations for curriculum improvements.

The highlights of the report can be shared with other EMS departments in order to encourage replication and identify additional opportunities for further interprofessional trainings. Additionally, if the report is shared with potential funding entities and municipal agencies it can encourage resource acquisition, which could secure the sustainability of the program and provide financial support for simulation equipment and trainer remuneration.

LOGIC MODEL

A logic model serves as a road map for CFD and other departments to plan, execute and evaluate the new OB training program. The logic model shown in Figure 6, below, outlines lessons from the participants and processes which can be evaluated prior to and following the training. The logic model answers the following questions (Community Toolbox, n.d.):

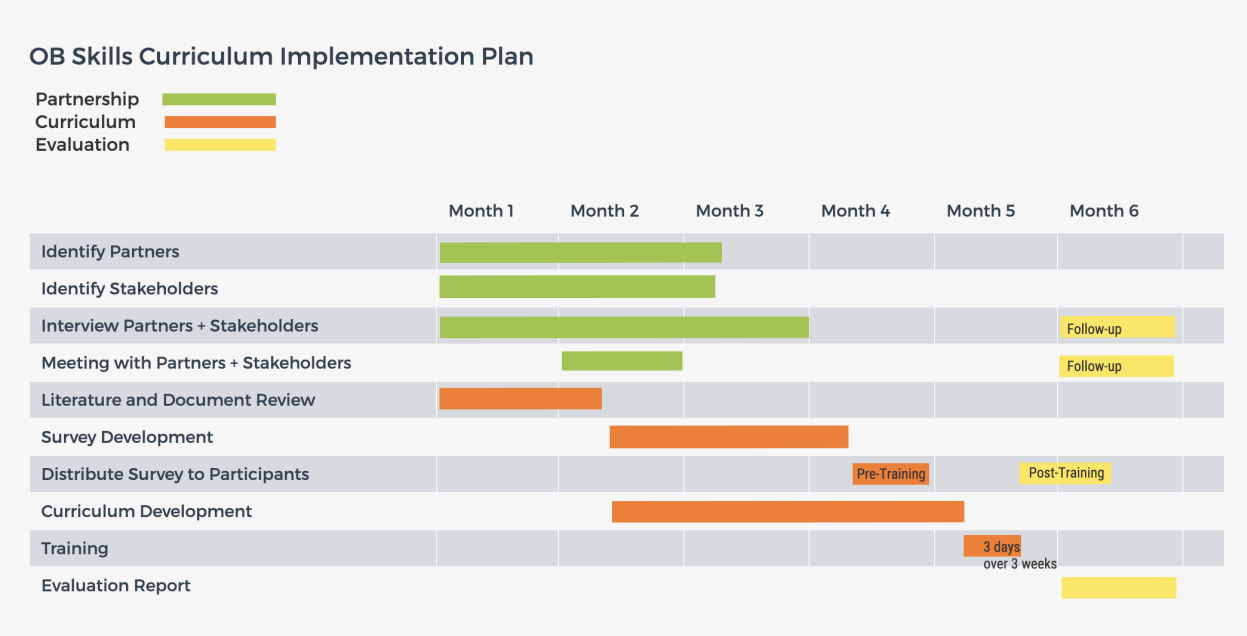
- Which stakeholders should be involved?
- Who participates in training curriculum development?
- Who teaches the training?
- How satisfied were attendees with the training?
- Did the training impact the confidence levels and skills of the attendees in the short and long term?
- Did the training improve rapport and collaboration potential between EMS and local midwives?
- Were there any negative reports from the training?
- If successful, how can resources be allocated to sustain the training?

Figure 6. Logic Model

IMPLEMENTATION PLAN

A sample implementation plan as shown in Figure 7, below offers a framework for executing a community-based EMS OB skills training in a six month timeframe. The plan includes activities to identify key stakeholders and partners, attain organization and partner buy-in, procure training documents, create a curriculum, get the curriculum approved, design and launch the training, and evaluate and report on outcomes with follow-up.

Figure 7. Implementation Plan



DISCUSSION

This project established that community-based participatory research and interprofessional education can result in a new training paradigm for EMS OB skills. Though multi-disciplinary collaboration is recognized as a crucial activity for the advancement of public health, and is embedded into the recommendations of the Public Health 3.0 report (DeSalvo,

Wang, Harris, Auerbach, Koo, & O'Carroll, 2017), it does not often make its way into practice. Perhaps this is due to the challenging nature of establishing trust and relationships which are foundational to successful partnership. Even if all stakeholders involved have similar priorities, values and goals, the process of partnership takes time to cultivate rapport, and a commitment to clarify, appreciate, and satisfy individual and organizational needs. This project's objective was to affect change at a granular level within CFD. Yet the result of integrating community midwives, simulations, and evidence-based practice into the CFD's OB continuing education curriculum had an extensive impact on the crews and leadership that reached beyond improved skills and self-efficacy. The project energized CFD to seek further opportunities for collaboration with the midwives, and to share their experience with other municipalities and departments in the region. One such promising result is the potential integration of Mobile Integrated Healthcare-Community Paramedicine (MIH-CP) for OB calls.

MIH-CP is an expansion of EMS services which "enhances access to primary care for medically underserved populations" (Kizer, Shore & Moulin, 2013, p.2). The majority of MIH-CP programs leverage off-duty paramedics to provide medical services and support for chronic heart disease, diabetes and lung disorders in the field (NAEMT, 2018). Yet, this model is well suited to include obstetric care with the help of community midwives by addressing two areas of focus: transporting non-emergent prenatal calls to alternative care and reducing postpartum hospital readmissions.

Currently, there is little information on MIH-CP programs specifically offering prenatal or postpartum services, yet similar models of collaborative, localized, coordinated maternity care exist – with Birth Centers achieving the best outcomes (Urban Institute, 2018). The Centers showed improvements in lowering preterm birth, reducing Medicaid costs, and improving patient

quality of care. These outcomes were less associated with the facilities and more to do with the holistic, personalized, "time-intensive" attention provided by their midwives in tandem with the "psychosocial support, health education, and referrals" provided by birth navigators or counselors (Urban Institute, 2018, p. 15).

The positive impact of the Birth Center model on the health of mothers and babies with low-resources has potential to be mirrored with MIH-CP – particularly for CFD. With its newly trained crews and relationships with midwives, CFD is well-aligned to join other community-based, interdisciplinary birth professionals in serving the majority of its OB calls: underserved pregnant women with non-emergent prenatal incidents. Allowing CFD to be the first point of contact in a network of maternal and child health providers can further improve crews' skills and their rapport within the community. More importantly, these connections can translate to high quality, effective, and efficient care – ultimately resulting in better perinatal outcomes for mothers and their babies.

CONCLUSION

Having midwives train EMS crews in OB skills with simulation provided an interprofessional approach to improving crews' critical competencies and confidence levels. The program used community-based participatory research methods to establish partnerships prior to implementation. The partnerships were essential to curriculum development and delivery. The training was grounded in evidence-based practice and included content that met Virginia's EMS certification standards, satisfying the requirements established by partners and participants alike.

Diverse providers worked together with confidence, collaboration, and trust to introduce a safe, robust, and cooperative system for supporting pre-hospital births in Charlottesville. Great

strides were made in improving the classroom skills and confidence of EMS crews using this pedagogical approach. However, further research is still needed to determine skill retention and the success of the training in practice, as well as its potential to improve birth outcomes in the field.

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APPENDIX

APPENDIX A

TRAINING SURVEY QUESTIONS

Section	Question	Answer Type	Answer Options
OB Training and Call Attendance	1. What is your job title?	Open field	
	2. When was your last OB/Neonatal skills training?	Multiple Choice	a. April 2018 b. April 2017 c. April 2016 d. Can't Recall
	3. How many OB/Neonatal calls have you been on in the past 6 month?	Multiple Choice	a. 0 b. 1-3 c. 4-6 d. More than 6
Self-Appraisal	4a. How confident are you in your OB skills and protocols?	Likert Scale	From "Not confident" (1) to "Moderately confident" (3) to "Extremely confident" (5)
	4b.What is your level of excitement when dispatched on an OB call?	Likert Scale	From "Not at all excited" (1) to "Neutral" (3) to "Very excited" (5)
	4c. How positive (ie excited, happy) or negative (Ie: intimidated, dreadful) do you feel about being dispatched on OB calls?	Yes/No	Y - Yes N- No
Self-Appraisal, Midwifery	4d. I have been on an OB call with a midwife present.	Multiple Choice	a. Medication administration b. Administer oxygen c. Suture minor tears

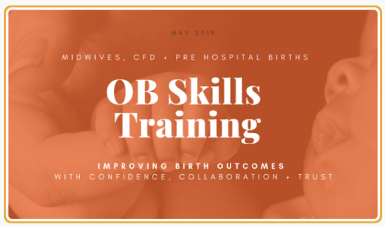
	4e. A Certified Nurse Midwife's (CNM) scope of practice includes:	Multiple Choice	d. Medication administration e. Administer oxygen f. Suture minor tears
	4f. What is your level of trust in the role of midwives and their skills in the field?	Likert Scale	From “Not at all trusting” (1) to “Moderately trusting” (3) to “Extremely trusting” (5)
	4g. How confident are you in co-managing both patients (mother and baby) with a midwife as an assistant?	Likert Scale	From “Not at all confident” (1) to “Unsure” (3) to “Very trusting” (5)
OB Skills Questions	5a. I learned something new at my most recent OB skills training.	Likert Scale	From “Strongly disagree” (1) to “Neither” (3) to “Strongly agree” (5)
	5b. A 37-year-old woman, who is 24 weeks pregnant with her first baby, complains of edema in her hands, a headache, and visual disturbances. When you assess her vital signs, you note that her blood pressure is 160/94 mm Hg. She is MOST likely experiencing:	Multiple Choice	a. eclampsia b. preeclampsia c. hypertensive crisis
	5c. While assisting a woman in labor, you see the cord with the head protruding from her vagina. She tells you that she feels the urge to push. You should:	Multiple Choice	a. lay her on her side and tell her to pant while you maintain pressure on the cord b. start oxygen, encourage her to keep pushing as you prepare for rapid transport c. flip her on hands and knees, insert your gloved fingers into the vagina, and push the head back up off the cord
	5d. You arrive shortly after the mother has birthed the baby. She is losing a lot of blood, more than 500 mL, you should::	Multiple Choice	a. immediately start a large-bore IV b. delay transport until the bleeding slows c. start uterine massage d. discourage breastfeeding

	5e. Upon delivery of the baby's head, you note that the umbilical cord is wrapped around its neck. You should:	Multiple Choice	1. immediately clamp and cut the cord 2. make one attempt to slide the cord over the head 3. keep the cord moist with sterile saline and transport as soon as possible 4. give the mother high-flow oxygen and transport rapidly
	5f. The need for and extent of newborn resuscitation is based on:	Multiple Choice	a. the 1-minute Apgar score b. the gestational age of the newborn c. the newborn's response to oxygen d. respiratory effort, heart rate, and color
Midwifery Questions	6a. In Virginia, Certified Professional Midwives (CPM) can carry oxygen to home births.	True/False	a. True b. False c. Don't Know
	6b. Midwives are certified in neonatal resuscitation and treating postpartum hemorrhage.	True/False	True False Don't know
	6c. What is the leading reason homebirth midwives transfer patients to EMS or hospital care?	Multiple Choice	a. Maternal exhaustion b. Umbilical cord prolapse c. Postpartum hemorrhage d. Don't know
	6d. You arrive to a home birth where the midwife has delivered the baby successfully and both mother and baby seem to have stabilized. The midwife advises that the mother no	Multiple Choice	a. Conduct a primary assessment on both mother and child b. Obtain patient refusal and go in service c. Call medical control d. Don't know

	longer needs transport. What's your next course of action?		
	6e. If called to a home birth attended by midwives and transport is needed, a midwife can accompany you in the back of the unit with the patient.	Multiple Choice	a. False b. True c. It depends (Please explain in 6f below).
	6f. If you chose "it depends" for question 6d above, type your explanation here. Otherwise, continue to the final question below.	Open Field	
Optional Feedback (this question only available for the post-training followup survey)	We value your feedback on your OB Training! You can let us know, for example: What worked, what didn't work, what you enjoyed, or what you didn't enjoy. Please enter your feedback below.	Open Field	

APPENDIX B

TRAINING SLIDES



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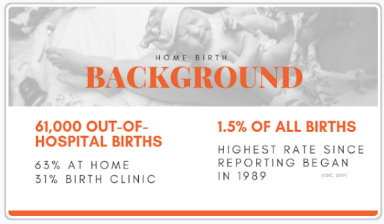

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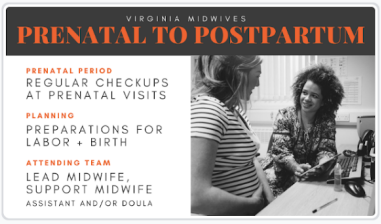

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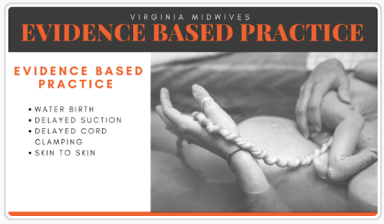

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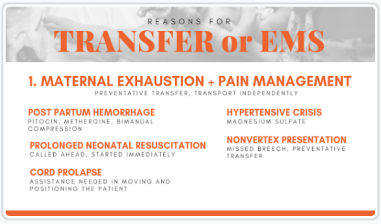

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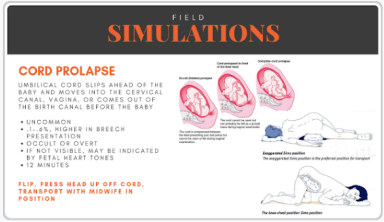

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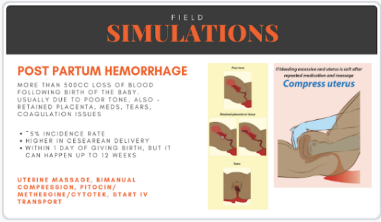

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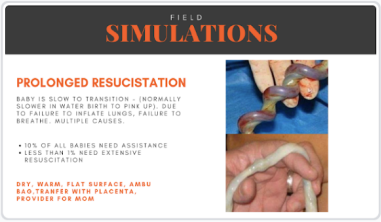

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